



AS THE YEARS  
PASSED





These men, many of whom were to make outstanding successes of their own in later life, were associated with Pratt & Whitney in 1870. From left to right, standing: — W. N. Woodruff, B. S. Woodard, Geo. Q. Whitney, Wm. Rogers, Chas. H. Cooley, Samuel Andrews, John Burden,, Frank Doughty, Wm. W. Tucker, Ambrose Swasey, Joseph Marvell and George Hoxie. Seated: Robert Francis, Worcester R. Warner, Francis A. Pratt, Frank Bryant and Edward Faxon.



**T**he year before the Civil War — in 1860 — Francis A. Pratt and Amos Whitney decided they would pool their meager resources and work out their own business destiny. They rented a small room on Potter Street in Hartford where they filled their spare hours with work done on their own account. At first they did not give up their jobs at the Phoenix Iron Works. The room was very unpretentious, containing only a few tools and a stove. What an impossible miraculous vision it would have been if they could have dreamed then of the world-wide success that was to come from their efforts!

One of the first accomplishments of the two men was the building of Spencer's Automatic Silk Winders designed for the Cheney Silk Mills in Manchester and later adopted by the Willimantic Linen Company. They did this so well that it brought more and more work to them and the name "Pratt & Whitney" began to seep through the metal-working industry.

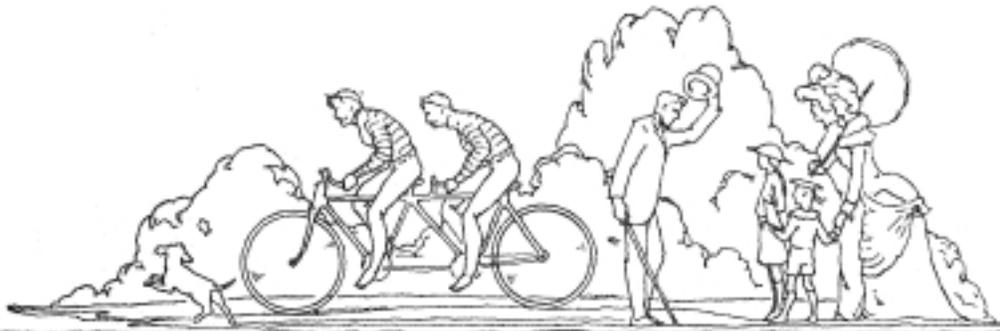
The road to the top, however, is seldom straight up. A fire burned out their little room and devoured everything they had. In less than a year we find them settled again in the "Woods" building which was in the rear of the old Hartford Times office. In these quarters they spent five successful years during the Civil War period until the growing plant could not be continued in the space, and they were compelled to move.

The urgent and multitudinous needs of the Civil War brought the partners more work than they could do. Because of their previous experience in Colt's Armory, both men were



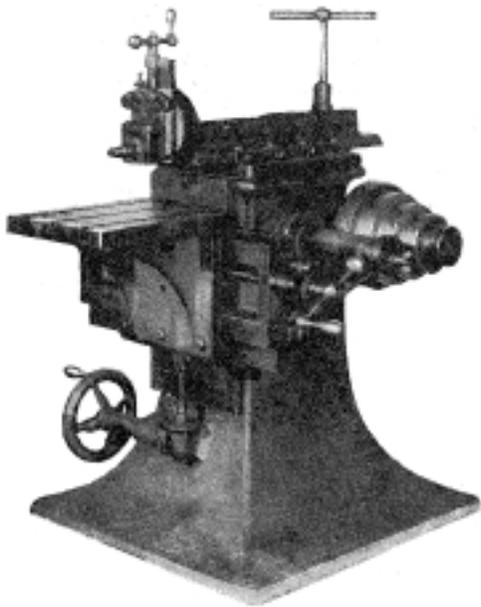
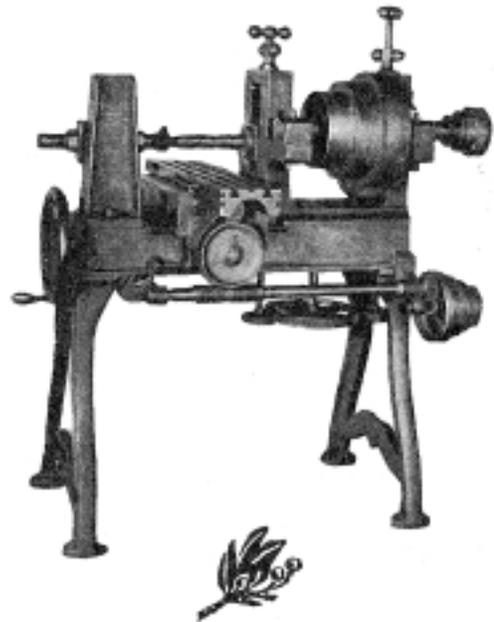
These men were active with the Company in 1886. The two central figures in the first row are Mr. Pratt and Mr. Whitney.



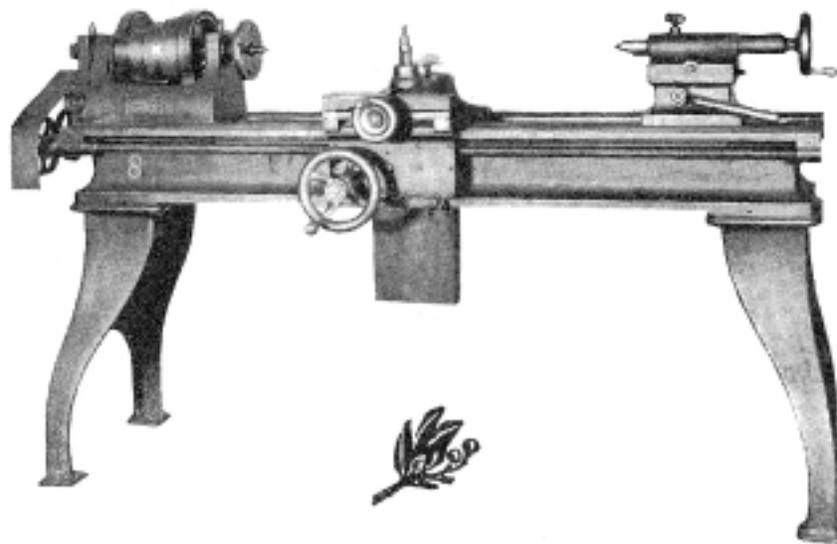


A group of Pratt & Whitney employees photographed in 1888.

These were the first machine tools built by Pratt & Whitney about 1860. They are preserved in the Ford Museum.



Above is a power miller known as the "Lincoln" miller. At the left is a horizontal shaper, and below is a lathe with a weighted carriage.



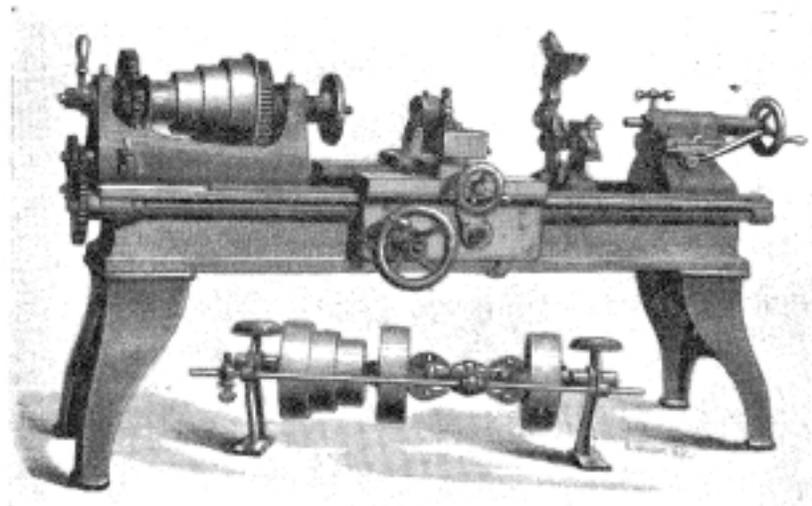
experts in gun manufacturing. Now the reputation of Pratt & Whitney as leading mechanics, as teachers of others, and as suggestors of new methods was clearly, definitely established.

In 1862 Monroe Stannard of New Britain, Connecticut, was taken into partnership. Each of the three men contributed \$1,200 in the business, but Mr. Stannard took active charge of the shop as the other two still were working at the Phoenix Iron Works. By 1865 the work in the new shop had grown to such an extent that a new building was started on the site now occupied by the plant, and in March of the following year when the building was finally finished, the two men resigned their positions at the Phoenix Iron Works to devote all their time to their growing business.

The new building was three floors high, and Pratt & Whitney occupied one entire floor. The other two floors were rented to the Weed Sewing Machine Company. Just as most new enterprises are laughed at and discouraged by the public at their start, dire predictions were made for Pratt & Whitney. They had bitten off more than they could chew, said the wise men of that day, and it wouldn't be long before the Weed Sewing Machine Company would own the entire building.

The sad prophets were wrong. Pratt & Whitney soon outgrew one floor, and the Weed Company was forced out by the young, sturdy and fast-growing Pratt & Whitney Company.

It is interesting to note that the inventory taken when they moved into the new factory showed that the original \$3,600 capital had grown in four years to \$75,000. But that was not

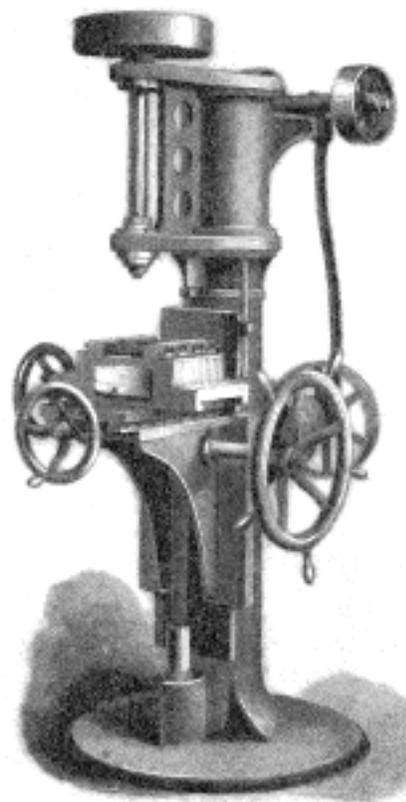
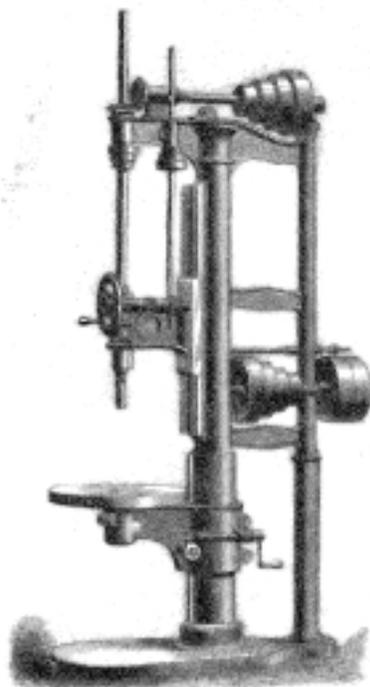


A lathe with  
gibbed carriage  
built about  
1865.

Upright drill  
1865.



Die sinker  
1865.

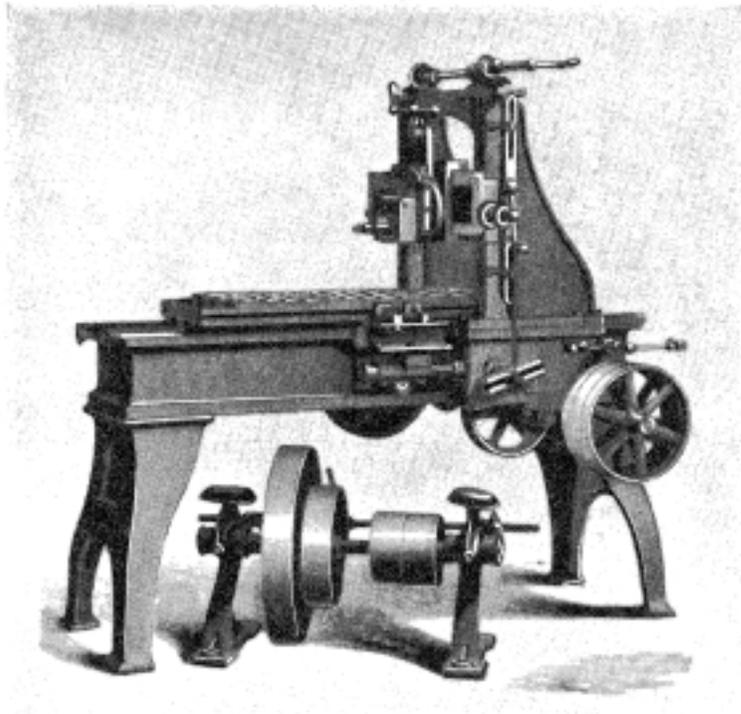


enough capital to carry out the large contracts that they had on their books, so Roswell S. Blodgett and Seth A. Bishop were admitted to equal partnership.

In July, 1869, the Pratt & Whitney Company was formally incorporated under a charter from the State at a capitalization of \$300,000. This was increased mostly by earnings to \$400,000 by 1873 and to \$500,000 by 1875. Every record of these years indicates the high position and esteem with which Pratt & Whitney were regarded throughout the industrial world. They won the reputation for fine workmanship and for accuracy which was their dominant aim, and that reputation, cherished and fostered ever since, is one of the Company's most priceless assets today.

Francis A. Pratt's brother, R. M. Pratt, (who was later to organize the Pratt & Cady Company, makers of valves and fittings) at one time had space in the new building. According to some of the old time workmen many of the valves used at that time, an automatic boiler feeder and return steam trap, were of Mr. F. A. Pratt's design.

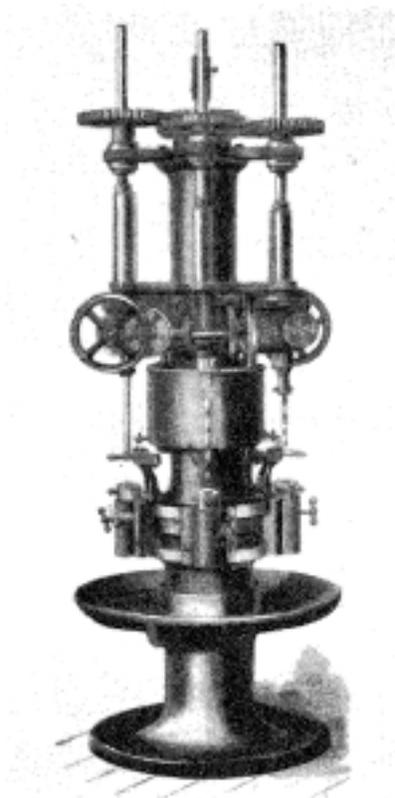
Soon after the Franco-Prussian War, in 1870, an agent of the Pratt & Whitney Company visited the Imperial and private gun factories of Germany. Scouting for business he discovered that these factories were using very antiquated machinery and tools. He interested a Berlin engineer in Pratt & Whitney methods and tools to such an extent that the engineer sent for Mr. Pratt. What a sales' trip that turned out to be! After an absence of six weeks, two of which he spent in Berlin, Mr. Pratt returned with orders for machinery from the German government totaling \$350,000. In the next three years he made six



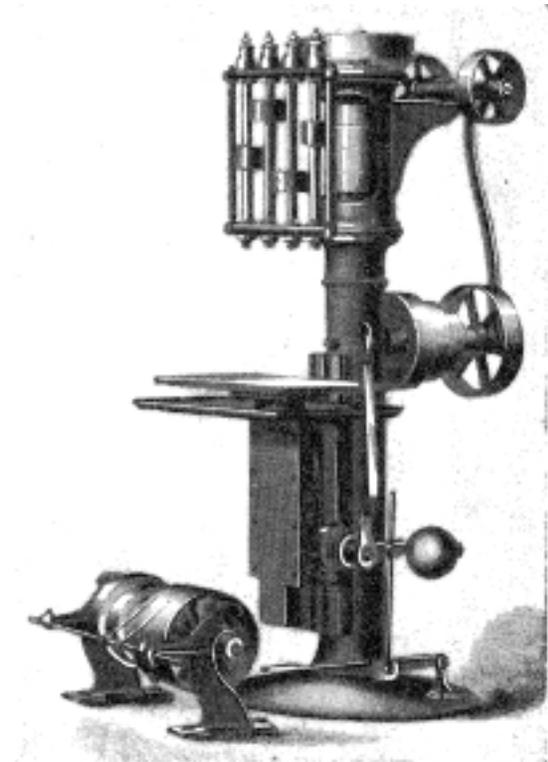
One of the first planers built by Pratt & Whitney about 1867



Four spindle drill of 1867.



Gang drill of 1867.

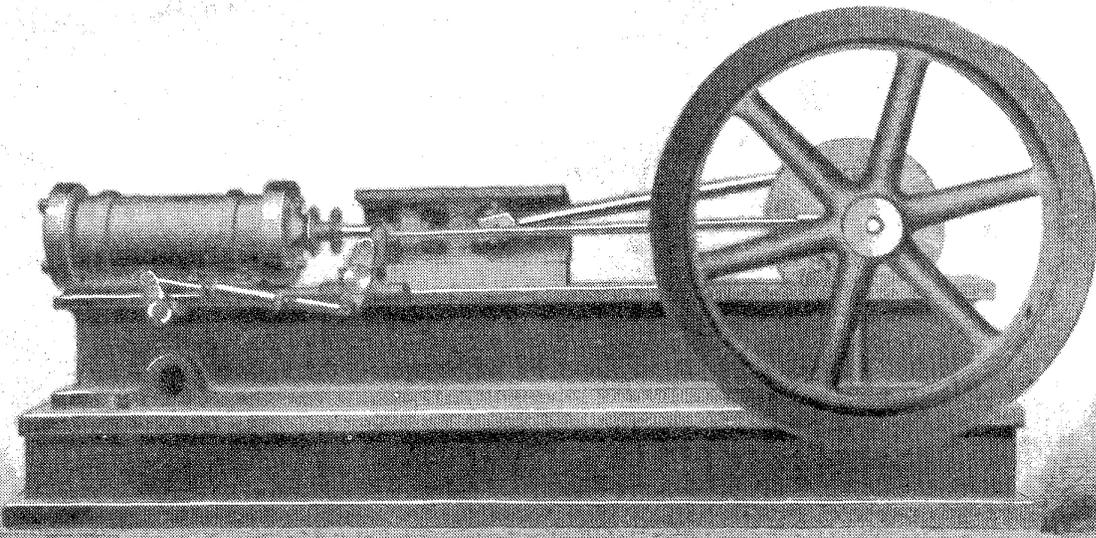


more trips to Germany and brought back orders for additional equipment and machinery to the value of \$1,250,000 — an outstanding transaction in those days.

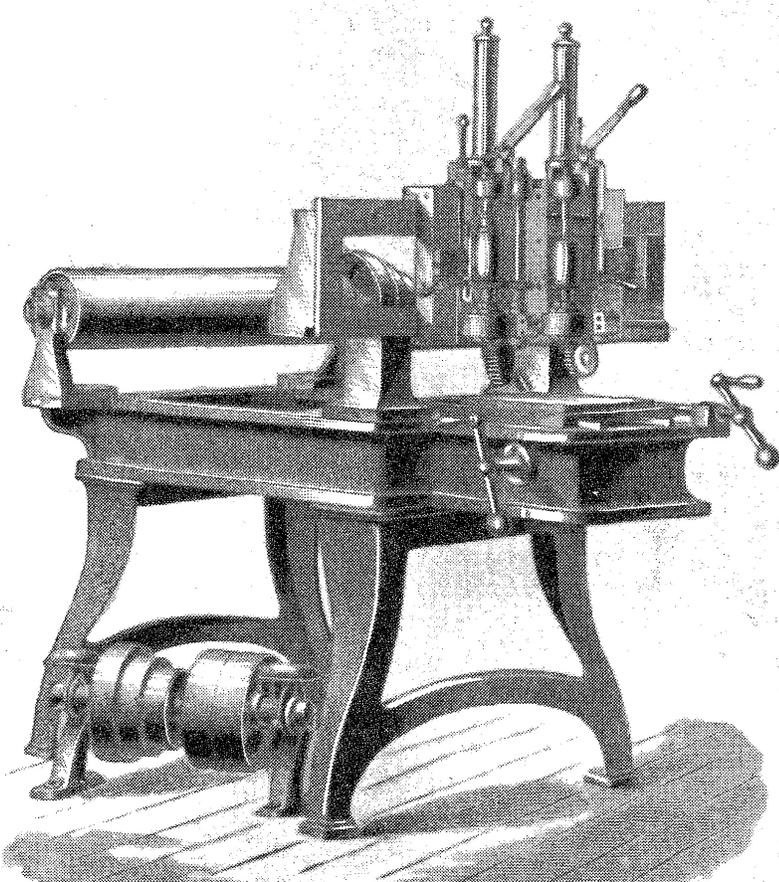
This German contract called for the delivery of the equipment to Hamburg, to be transferred to three different Prussian arsenals. A supplemental contract called for the supervision of erecting and testing the equipment, and instructing the German operators. This work was done so well that the German government wrote a letter, entirely contrary to its own precedent, a part of which was as follows:

“The Pratt & Whitney Company has furnished the Royal Armories of Spondan, Erfurt and Donsitz with plants of machinery which execute the work with such nicety and precision as to save one half the wages, and to render the Government in no small degree independent of the power and skill of the workmen”.

The Civil War had given to Pratt & Whitney its real start in the manufacture of firearms. It was the experience gained in this work that turned the thoughts of both men toward the idea of making interchangeable parts “as like as peas in a pod”. Work of such a precise nature had never been even attempted before, and the idea was scoffed at by seasoned mechanics. In those days every piece of machinery was assembled and fitted by hand, and no two parts supposedly the same would interchange. This new idea of interchangeability had been thought of and talked about to some extent by Eli Whitney and Samuel Colt, but it remained for Amos Whitney and F. A. Pratt to make the idea practical on a large scale. As a result Pratt & Whitney Company became pioneers and leaders in developing and



A reciprocating hydraulic engine built in 1876. It developed 2 to 3 horsepower with a head of 100 feet, and used 53 gallons per minute.



Two spindle profiling machine of 1870.

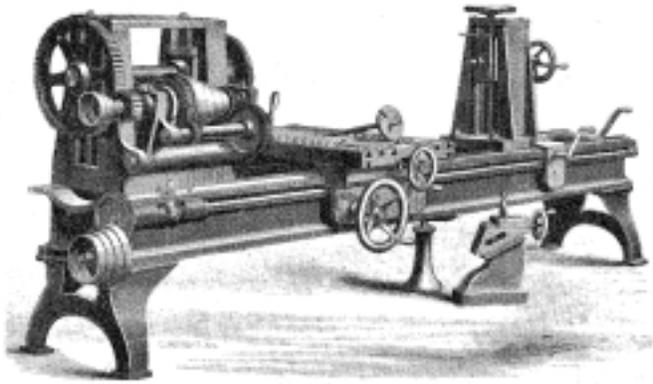


applying the new system of interchangeable manufacture. Much of the success of this system depended upon the development and use of accurate gages and trustworthy standards of length.

Pratt & Whitney, from the very beginning, improved and perfected the standards of length and commercial methods of precision measuring which have resulted in such great improvements, and have led directly to modern interchangeable manufacturing and mass production. In 1860 there was no commercial standard inch. The length of a commercial standard yard varied with the number of yard-sticks.

This was a serious obstacle to future interchangeable work. From their efforts to overcome this Pratt & Whitney developed a Gage Division in their organization, which was destined to play an important part in most of America's mechanical developments.

They realized that a practical standard inch of exact dimensions was the basic requirement upon which the entire system would have to be built. Here was shown the keen foresight of Amos Whitney. He was convinced that the day would come when machinery would lift the heaviest burdens from the backs — and hearts — of men and women. While he could not actually visualize a modern sewing machine or telephone he knew that such things and many more were certainties because civilized life would demand them. But he did see that only through mass production could mechanical devices reach down and help the masses. He predicated that costly hand work must give way to mechanical mass production of parts, held to exact dimensions by tools we now call gages, and that through this would come the great mechanical age, when steel and iron

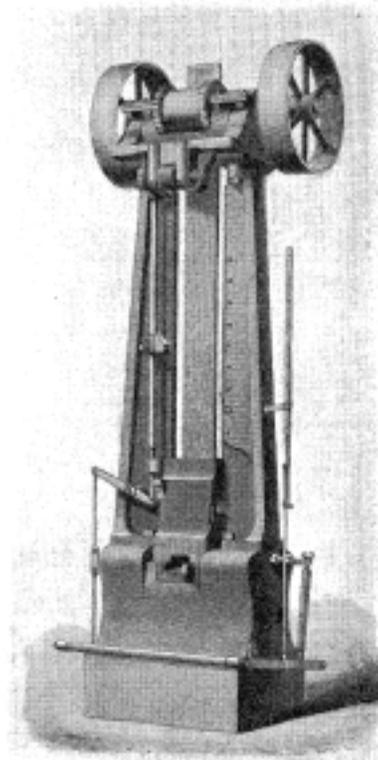
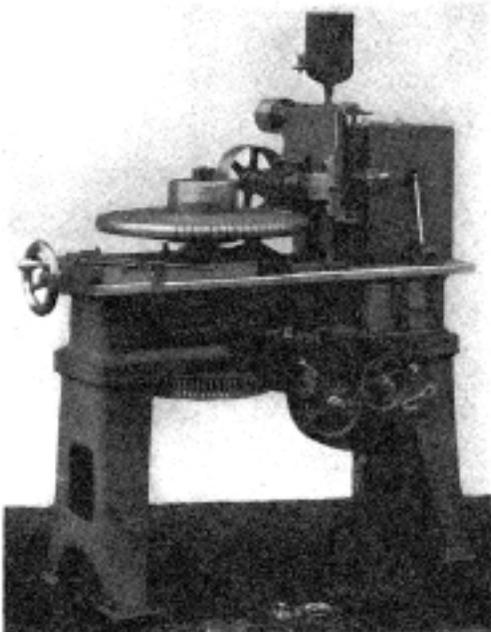


Horizontal boring mill of 1878.



An early gear cutting machine.

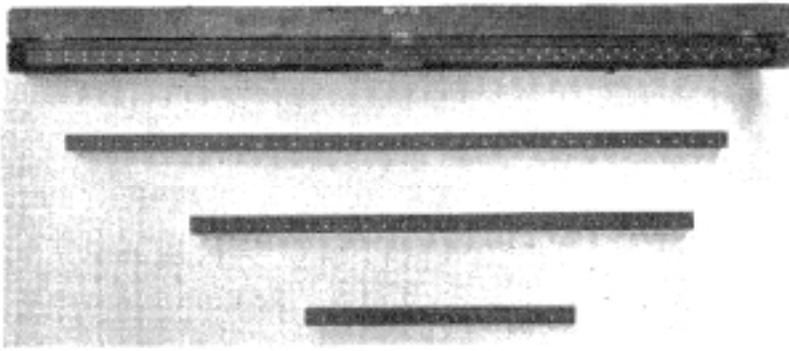
One of the first board drop hammers.



would lift and carry instead of brawn and muscles — when machines would even do the work of brains.

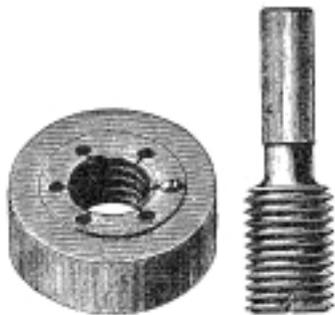
Pratt & Whitney established the inch. The standard was accurate to millionths of an inch. Those two short sentences contain a long story of patient endeavor involving the conception and development of the new historically famous Rogers-Bond Comparator. Early in 1879 William A. Rogers, then a professor of astronomy at Harvard College, aided by George M. Bond, a graduate of Stevens Institute of Technology, commenced a series of efforts continuing through the three following years to create a comparator for absolutely correct measurements within a limit of one fifty-thousandth of an inch. These men were backed entirely by the skill and resources of the Company and the inspirational support of Pratt & Whitney.

When they began, tools used for measurements in different shops varied widely in dimension. First in London and later in Paris Professor Rogers obtained a reliable transfer of both the British Imperial Yard and the French Meter d'Archives. With the co-operation of the United States Coast Survey, the most delicate and exhaustive comparison of the standard bars prepared by him for the use of the Company were made with the United States Standards Yard designated as Bronze No. 11. Years of time and many thousands of dollars went into this work. The net result was that Pratt & Whitney Company succeeded eventually in making several accurate copies of the British Standard Yard, the French Meter d'Archives and the American standard of length known as Bronze No. 11. These famous bars are still among our prized possessions. They were the basis of Pratt &

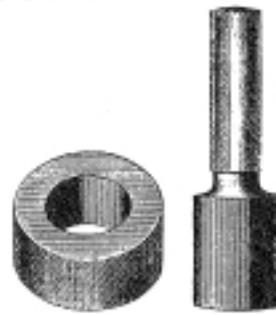


Four of the master bars accurate within millionths of an inch, made about 1880.

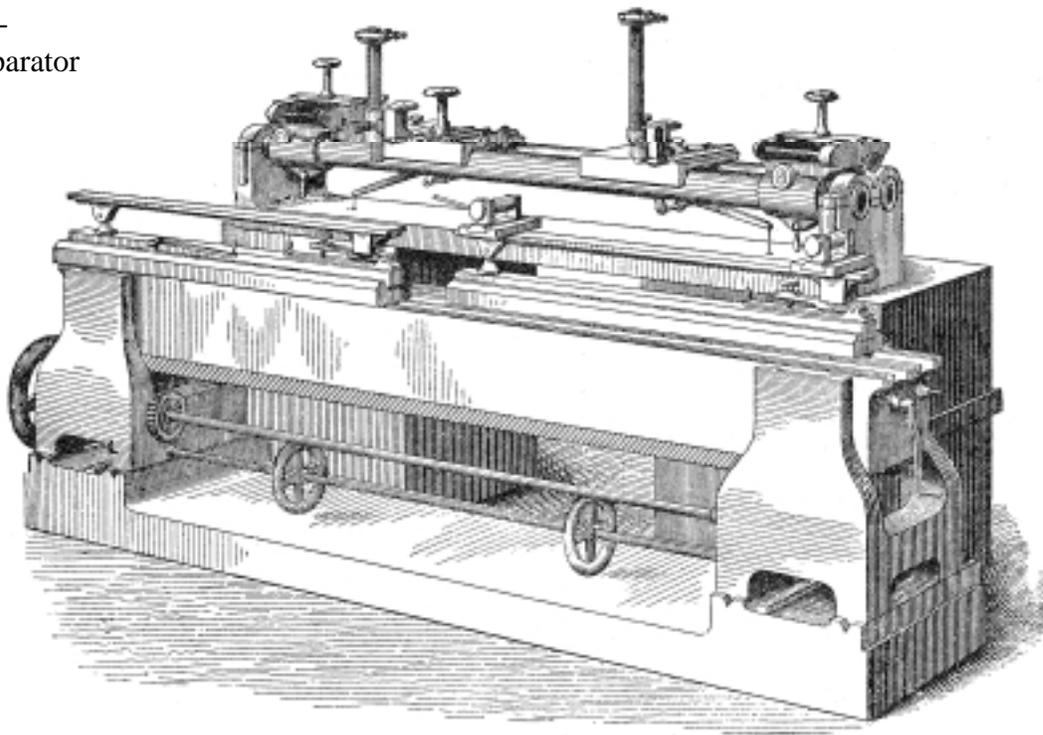
Early thread gages made in 1876.



Cylindrical gages of 1876.



The Rogers-Bond Comparator



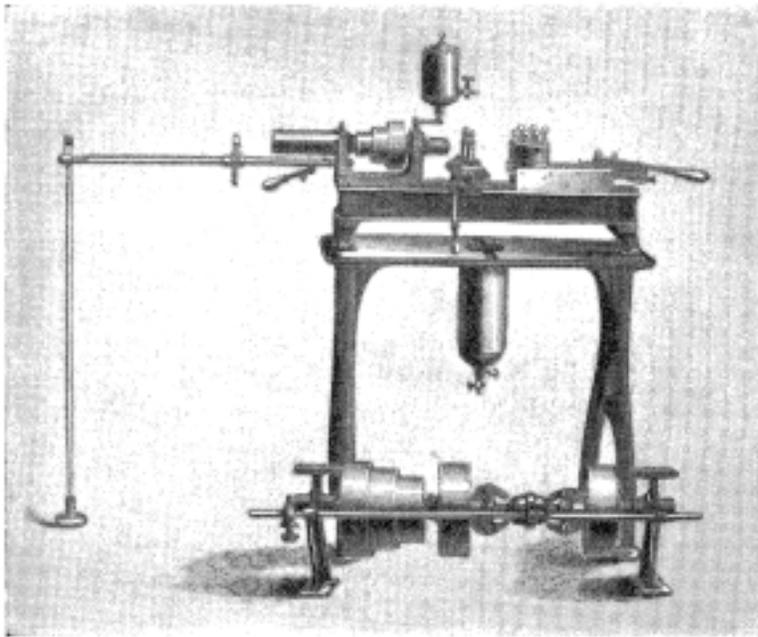
Whitney accuracy, and established the company as the outstanding authority on accuracy.

The result of this research, combined with the Rogers-Bond Comparator, eventually brought about the development of the Pratt & Whitney Standard Measuring Machine. There were many problems to overcome in the creation and building of a measuring machine which must be accurate to one hundred-thousandth of an inch. They were solved successfully, however, and the Pratt & Whitney Standard Measuring Machine is known all over the world today as the basis for the construction and duplication of recognized standards of length. This work was practically completed in 1885.

Needless to say the original research connected with making the Grand Masters entailed much equipment and expense. As time went on, that equipment was added to and replaced by new devices of Pratt & Whitney invention. The ability to measure accurately and quickly brought many new ideas and inventions to their doors for solutions of production difficulties. Mr. Whitney's early predictions were fulfilled when one thing after another was developed as a direct result of interchangeable manufacture and mass production methods.

In quick succession came the sewing machines, typewriters, typesetting machines, automatic counting and weighing machines and many others. With each one the story was the same. Pratt & Whitney gaging methods made it possible to produce the parts in quantity so that those parts would assemble with precision.

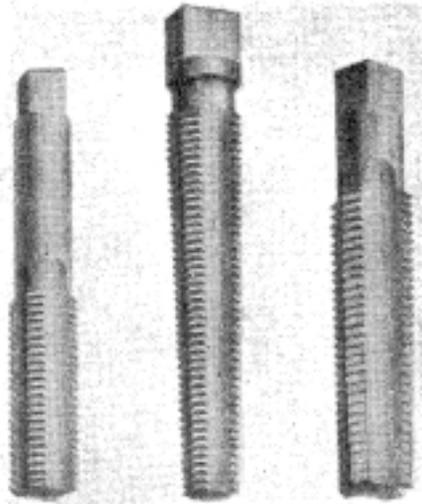
This briefly is the story of the Gage Division and its development, and it runs like a golden thread through the entire



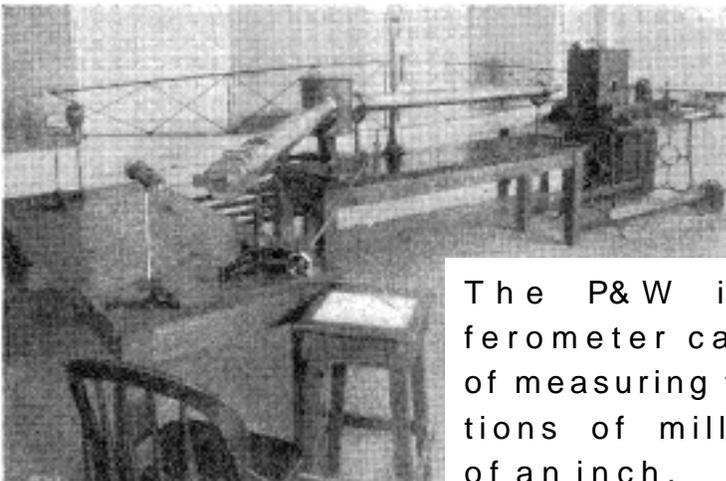
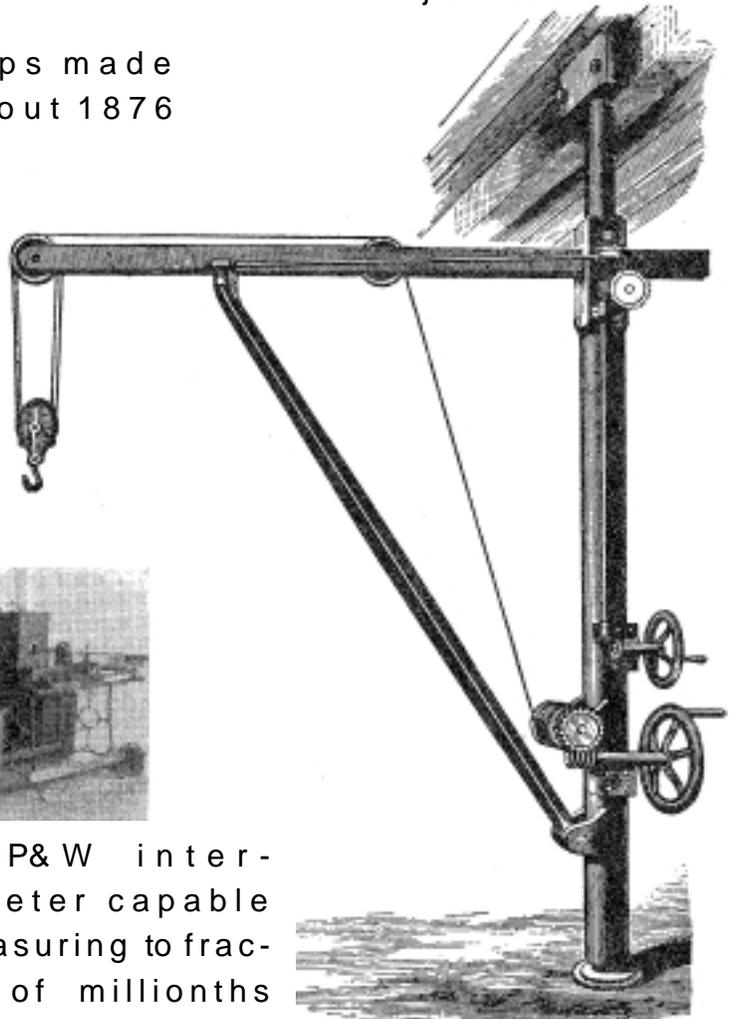
One of the early hand screw machines with wire-feed made about 1876. Several sizes were listed in catalogs of that period.



Pratt's patent jib crane.



Taps made about 1876



The P&W interferometer capable of measuring to fractions of millionths of an inch.

history of modern mechanics and the metal-working industry.

Pratt & Whitney's European business settled down into a regular, steady, well-developed trade, fluctuating, of course, with changes in general conditions. Shipments were made to nearly all European nations, and goods were delivered to points as far remote from lines of public transportation as the eastern borders of Siberia.

In 1893 the capital of the company was increased from \$500,000 to \$3,000,000.

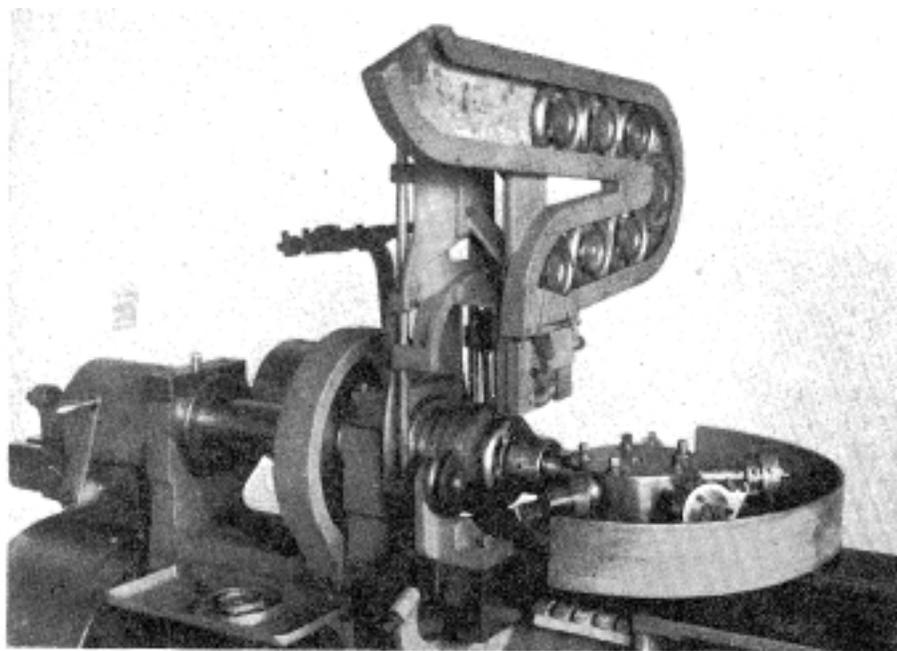
Francis A. Pratt had continued to be president and Amos Whitney superintendent since the date of organization. R. F. Blodgett was the first treasurer. In 1878 the mechanical had outgrown the financial side of the business. At this time William A. Healy, a man of keen insight and large resources, after a careful inspection of the plant, accepted the treasurership and advanced \$200,000. At his death, in 1885, he was succeeded by Miles W. Graves. Both rendered highly valuable services to the company. Mr. Graves retired in 1893. The officers of the company in 1897 were as follows:

Francis A. Pratt, president; Amos Whitney, vice-president and superintendent; George W. Reed, second vice-president and general manager; C. C. Tyler, assistant superintendent; R. F. Blodgett, secretary; J. C. Stirling, treasurer.

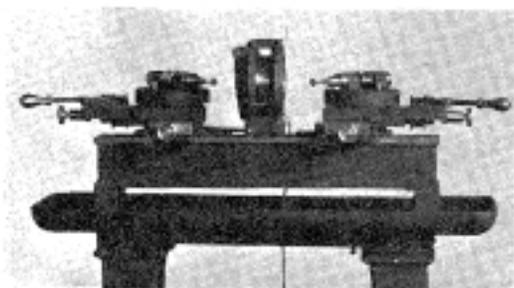
In 1898 Mr. Pratt retired.

He still gave the company the benefit of his valuable experience and mechanical knowledge as Consulting Engineer. Mr. Amos Whitney was elected President.

The products of the Pratt & Whitney Company from the earliest days up till the 1900 period were astonishingly varied.



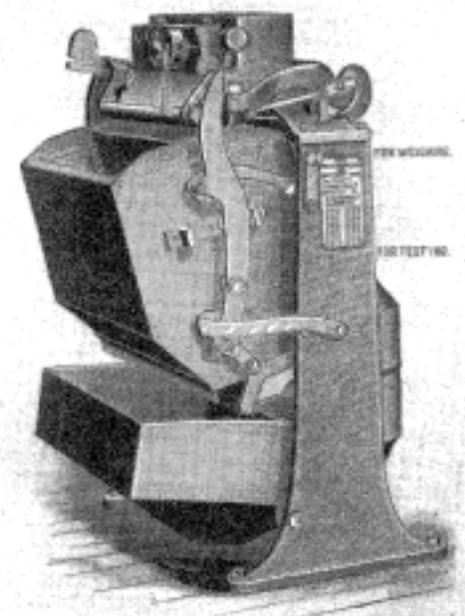
An automatic machine for finishing sewing machine wheels. Typical of many machines for sewing machine parts.



Cup and cone grinding machine used to finish bicycle bearings.



Automatic weighing machine for grain.



Machine for drilling spoke holes in bicycle wheel rims.

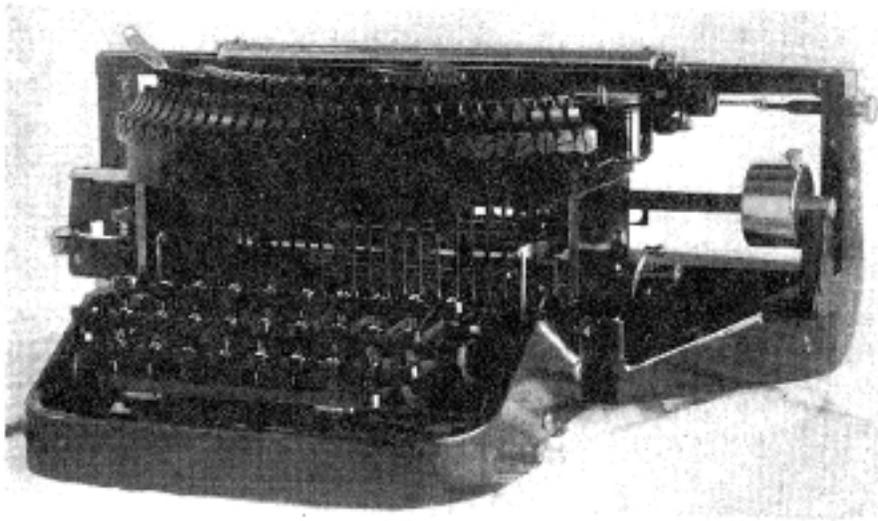


The Company must have built anything and everything in the machine tool line as well as untold quantities of special machines, and devices which were developed for outside companies and individuals.

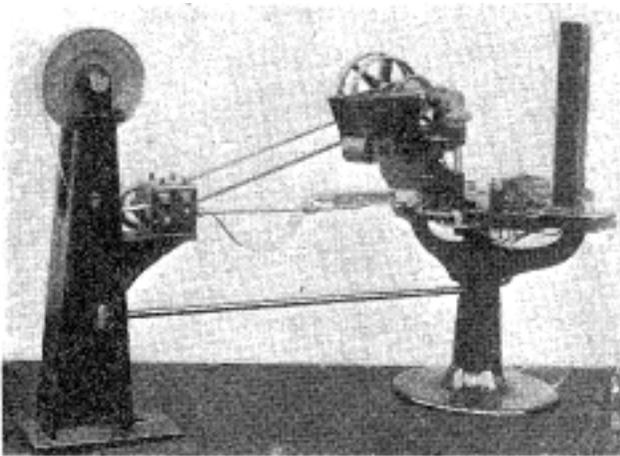
Apparently no attempt was made to specialize on any one type of machine tool. There were many and various types of lathes, boring mills, shapers, planers, vertical drills, multiple drills, grinders, screw machines, tapping machines, milling machines, cam cutting machines, die sinkers, profilers, various power presses, broaching presses, power hammers, and many other. Mixed up with these were some of the early gun machines, a crane, a reciprocating hydraulic engine, a cartridge-varnishing machine and a great variety of bolt cutters. There are various types of taps, dies, drills, wrenches, some early gages including both plain and thread gages, combination lathe chucks and iron molders flasks.

The manufacture of sewing machines and bicycles with the necessity for interchangeability provided a great deal of work for the company at this time. Gages, tools, fixtures, machines and small tools were made in large quantities, and in some instances, complete equipment was furnished for entire factories.

Automatic weighing machines for grain, coal, etc., were manufactured about 1890, and the Company was evidently one of the pioneers in this industry which now occupies the entire attention of several large concerns. This section of their business was later purchased by the Automatic Weighing Machine Company. In connection with these machines there also was built a counter device similar to the ones in use on machine tools today. It was patented in 1895, but whether it was the

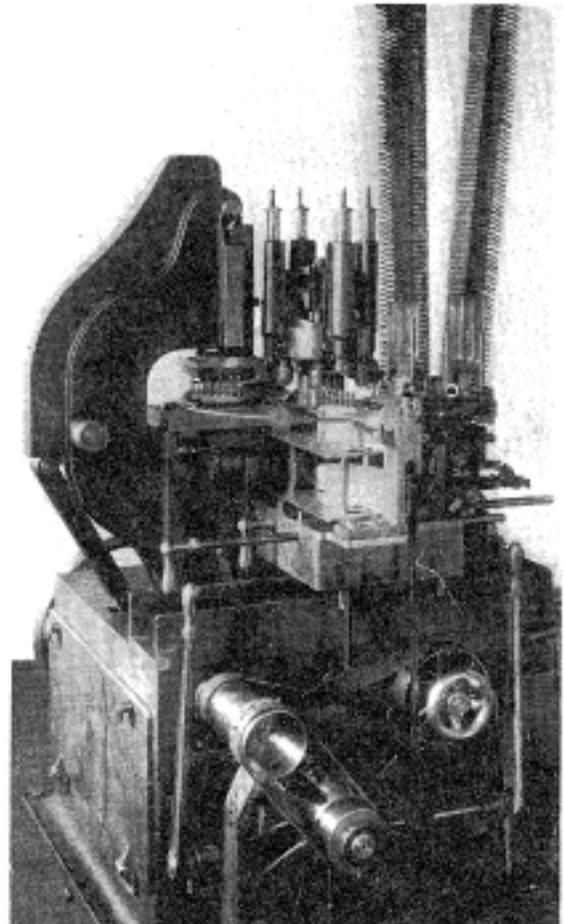


The Kidder typewriter (1900) ancestor of the present noiseless typewriter.

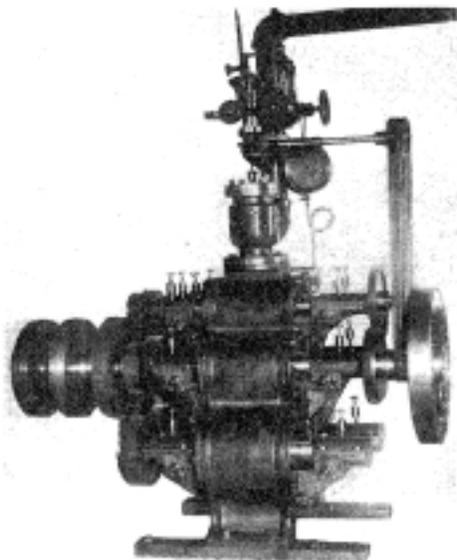


A cigarette packing machine.

Envelop making machine.



Morse Rotary Engine.



first to be introduced is a question. At that time Mr. Veeder was already building cyclometers.

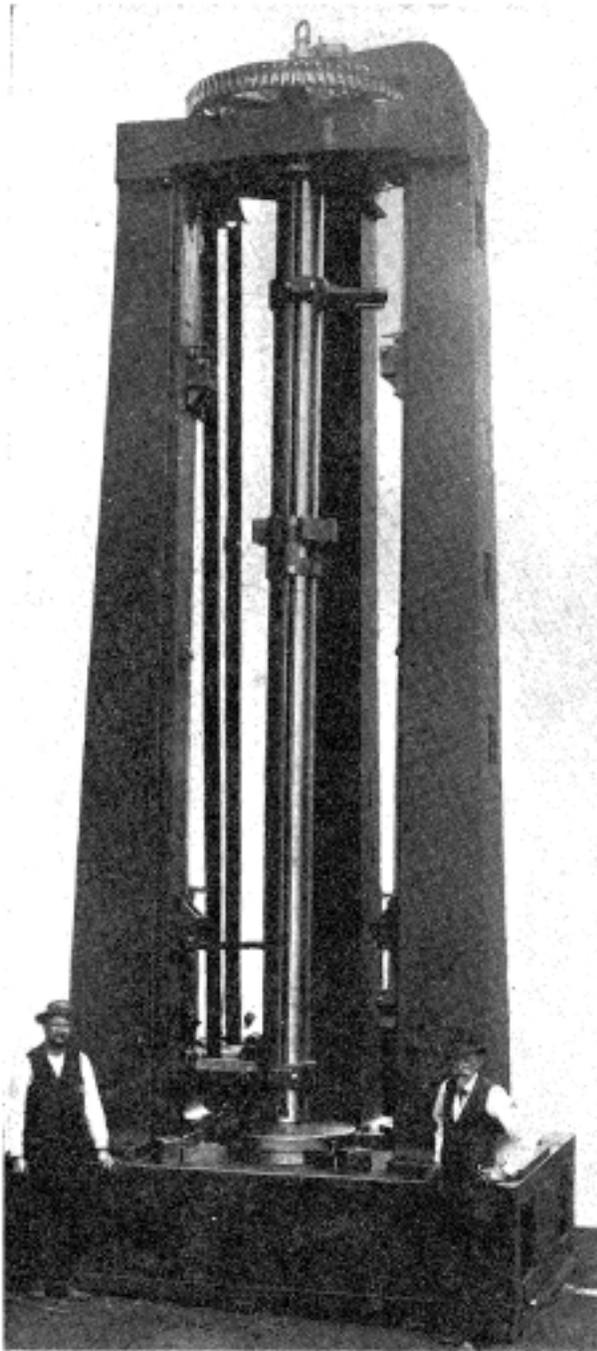
Pratt & Whitney's activities as gun smiths and manufacturers of machinery for making guns brought them many models to be developed under the supervision of inventors. Among these was the Lee gun, the forerunner of the Lee Enfield and the Medford, and really the father of all bolt action guns. The Mauser was developed under the personal direction of Mr. Mauser. The Sponsel gun, an adaptation of the Hotchkiss, the deKnight machine gun, and a Remington model all were made in this shop.

The first model noiseless typewriter as well as the Moore and the Sholes typewriters were developed. The Hollerith tabulating machine was built at Pratt & Whitney Company with the assistance of Mr. Bond — the Bond of the Rogers-Bond Comparator.

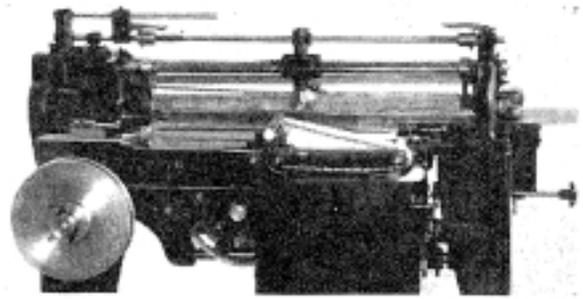
Envelope machinery was built under the direction of Mr. F. H. Richard who also developed the automatic weighing machine. This work later became the property of the United States Envelope Company.

In 1889 to 1890 the original model of the Paige typesetter was built at Pratt & Whitney Company. The development of this machine is reported to have cost Mark Twain several fortunes. This machine proved far too expensive to build, but its design formed the basis of the Mergenthaler and other typesetting machines used today. The original model now is in the Sibley College of Engineering, Cornell University.

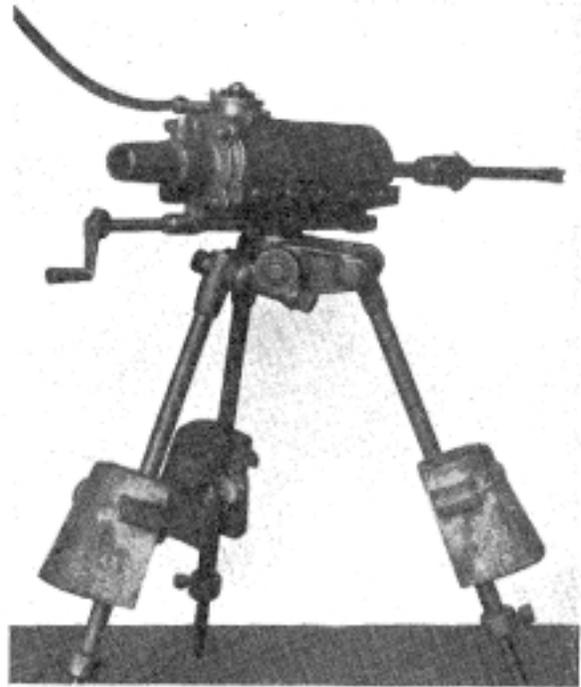
In 1901 the Niles-Bement-Pond Company purchased the Pratt & Whitney Company and reorganized it. At that time,



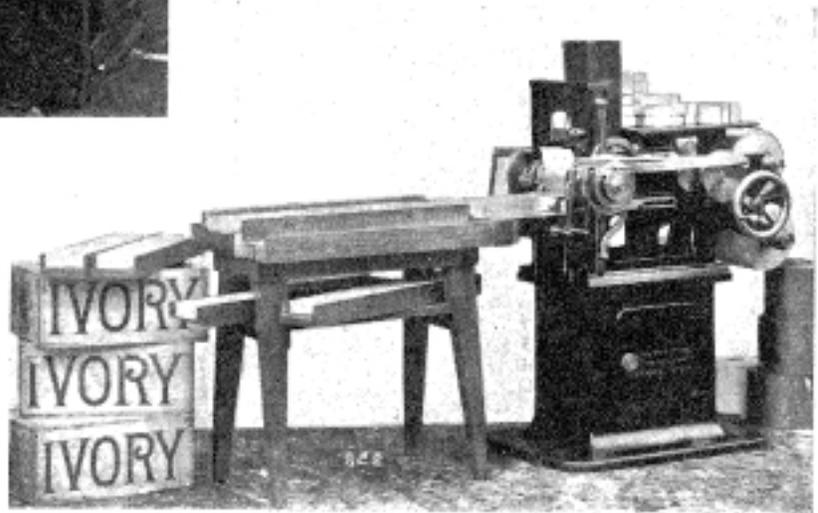
Hydraulic elevator piston machine.



Tobacco stripping machine.



Rock drill.



An early soap wrapping machine.



Mr. F. W. Gordon was sent to Hartford as a representative of the Niles-Bement-Pond Company to act as General Manager. Under Mr. Gordon and the officers of that period the shop of the Pratt & Whitney Company was thoroughly reorganized, and more attention was paid to manufacturing on a quantity basis. Mr. Dudley Seymour, Mr. C. C. Tyler and Mr. B. M. W. Hanson were associated with Mr. Gordon at that time. Mr. Hanson afterward became a Vice-President, and later when the Pratt & Whitney officers were discontinued, and the Niles-Bement-Pond Company interests consolidated in New York, he was made General Manager, which position he held until July, 1917.

A record of the activities of the company since 1901 shows that the gun interest still predominated strongly. In 1904 a contract with the Japanese Government called for the building of tools, gages and machinery for making shrapnel shells (7.5. c.m. projectile) at the rate of 700 a day, and following this came an order for 6 inch naval gun sights for the United States Government.

In 1909 Pratt & Whitney secured a contract for the Australian Arsenal at Lithgow, Australia. Bids were called for in London, for a plant having a production capacity of fifty Lee-Enfield rifles per day. When Pratt & Whitney Company sought permission to bid, it was thought impossible to build the plant outside of England, as there would be no access to British Gages, and the Australian and British gun parts must interchange.

Pratt & Whitney Company declared they could produce a plant to duplicate the British weapon by using the interchangeable system of manufacturing. The best English bid and the



Amos Whitney's 85th birthday party, Oct. 8, 1917  
Mr. Whitney is standing in the center.



A Pratt & Whitney band of 1905.



Pratt & Whitney bid were almost identical, but the English firm required 700 machines to do the work against the Pratt & Whitney estimate of 300.

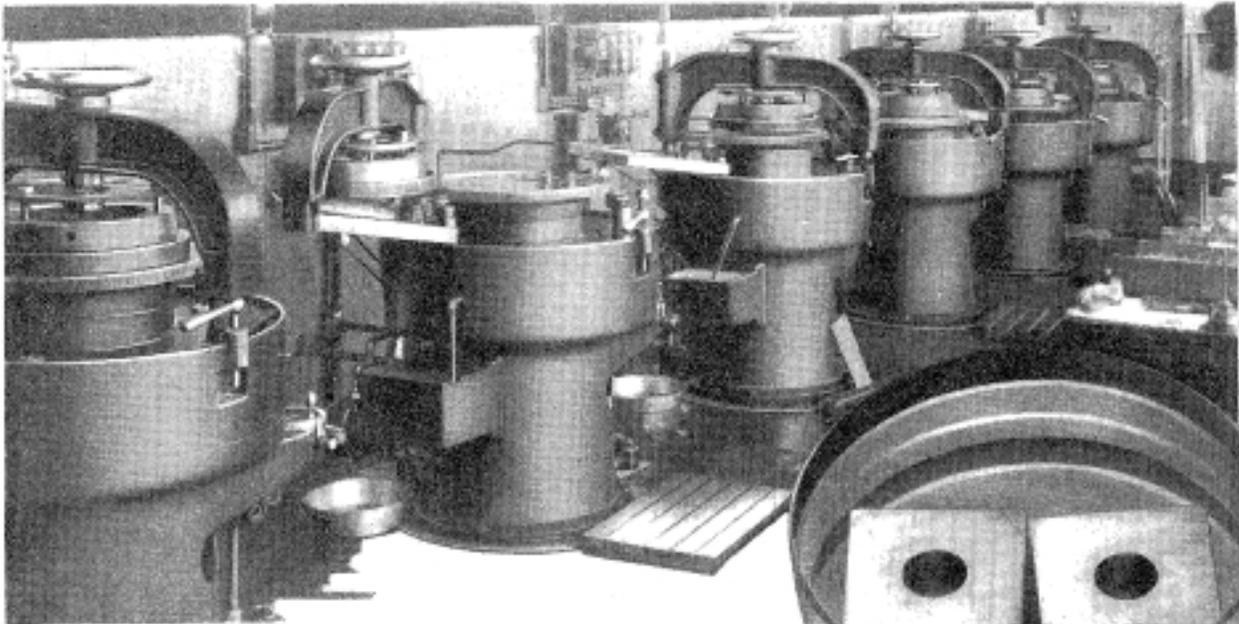
The question of working hours to produce a gun also came up, and Pratt & Whitney Company guaranteed twenty-three hours per gun against the English seventy-two hours.

Commander Clarkson was sent to the United States to investigate, and the contract was awarded to Pratt & Whitney Company, as he found their equipment far in advance of anything he had seen previously. The machinery was tested before shipment from the United States and the time per gun actually was lessened. Experts from Hartford were sent to Australia to set up the plant and train the operators. In 1912 the plant was in full operation, and one of the Hartford men was retained as manager of it.

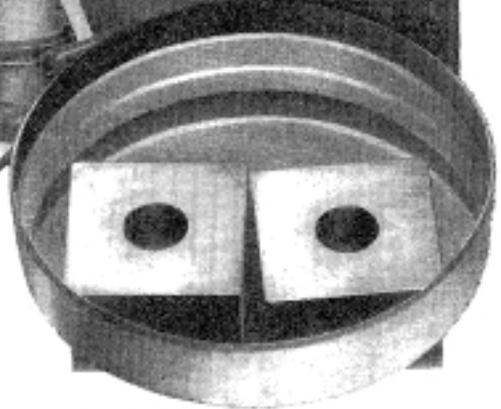
It was not always war and guns that brought business to Pratt & Whitney. The automobile industry provided a large amount of work for the Company and many plants were equipped with Pratt & Whitney machines, small tools and gages during the great era of motor car building.

When war came again, the World War of 1914, the Company was called upon to produce arsenal equipment on a scale that was hitherto undreamed of.

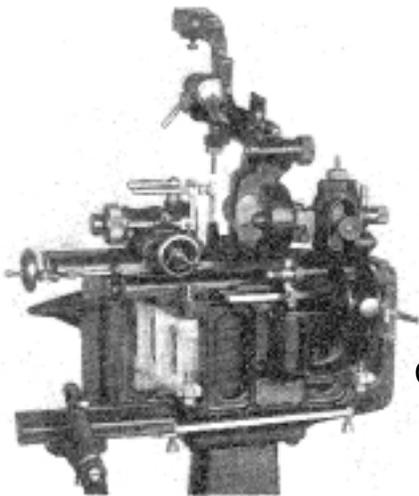
It was in 1914 also that the buildings of the Pope Manufacturing Company, next-door to Pratt & Whitney Company in Hartford, became available and the entire plant was purchased by the Niles-Bement-Pond Company. This supplied a great deal more floor space which was soon utilized fully. This enlarged floor space gave the Pratt & Whitney Company an



A battery of Hoke Lapping Machines.



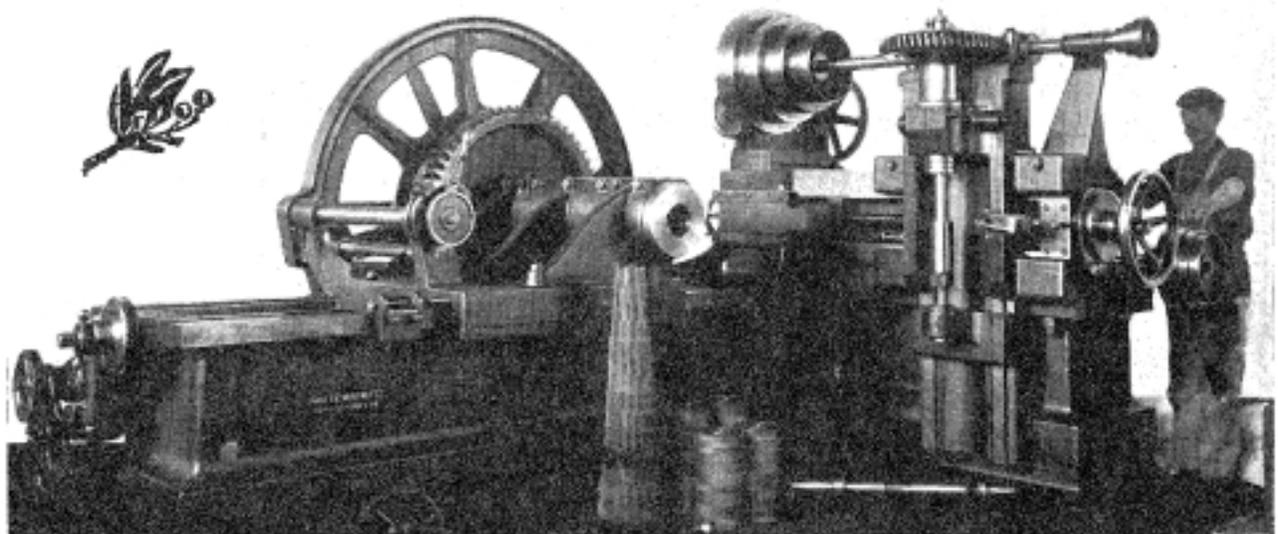
Hoke blocks being tested for flatness to millionths of an inch under an optical flat.



Contour Cutter Grinder.



120" Gear Cutting Machine.



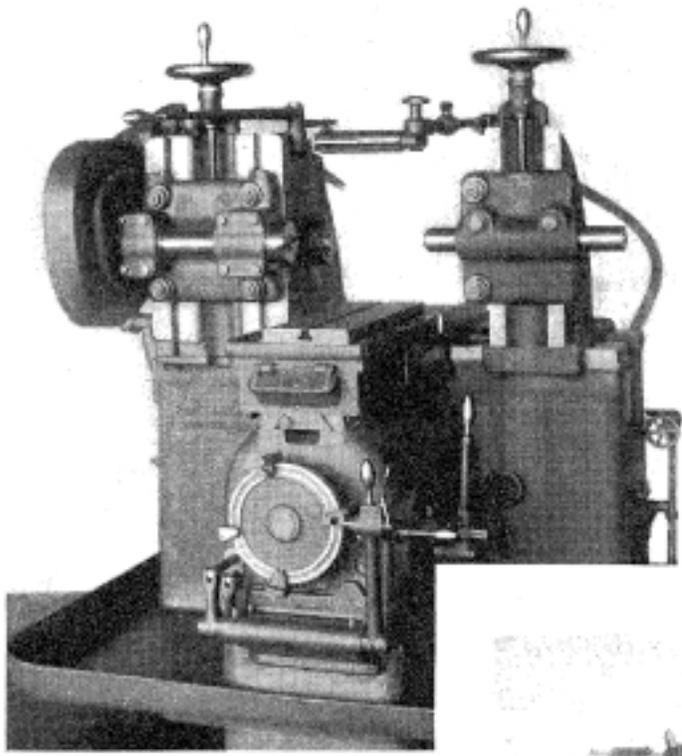
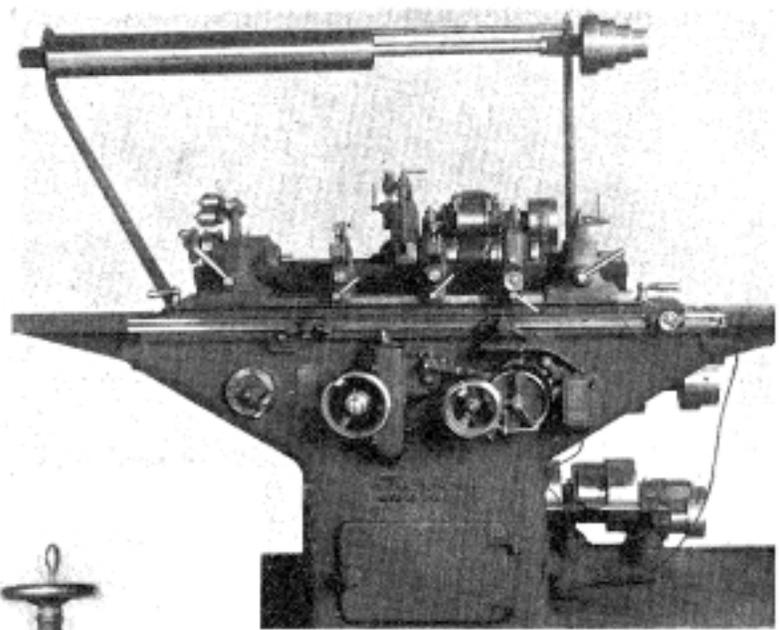
opportunity to expand rapidly. In 1914 gun making machinery was in great demand everywhere, and the company was swamped with orders from abroad involving millions of dollars.

With the entrance of the United States into the World War the demand upon the Pratt & Whitney Company increased greatly. Additions were made to existing American arsenals. Much new equipment was necessary, and a score of gun factories sprang up over night. Not only was Pratt & Whitney Company called upon to supply machines, but also to design and build tools and gages for the manufacture of the large guns including the 155 and 240 m/m guns and howitzers.

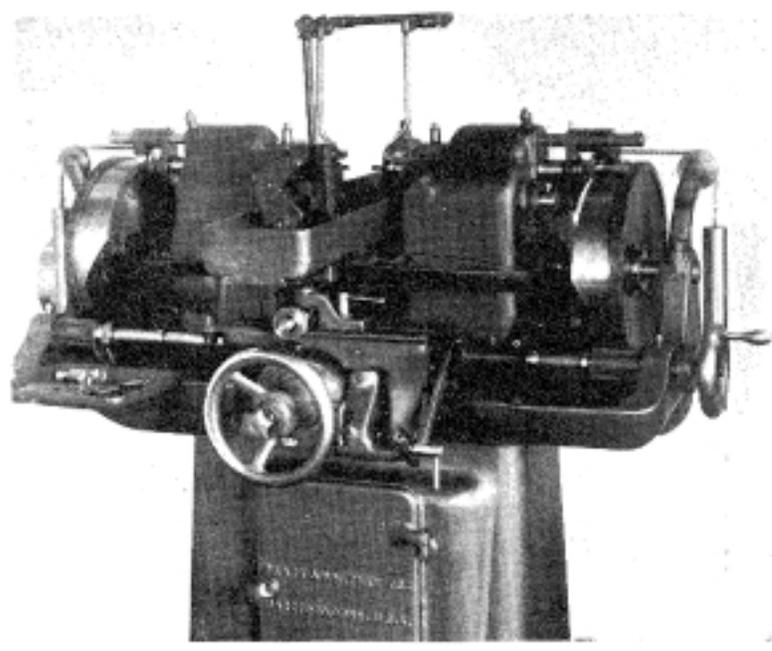
After the World War the machine tool business continued very actively for about two years. Mr. B. H. Blood had been made General Manager of the Company in 1917 following Mr. Hanson, and it was under him that a great deal of time was spent in the development of precision gages. During the war there had been a pronounced shortage of accurate gage blocks that were imported from Sweden in very small quantities and at high prices.

Major Hoke of the Ordnance Department of the United States Government originated a system of precision lapping, and produced blocks of far greater accuracy than had heretofore ever been manufactured. After the war the Pratt & Whitney Company obtained the right to manufacture these blocks, and developed the original idea, which was largely a laboratory process, into a practical manufacturing system. The result was that blocks were produced which could be guaranteed permanently accurate within five millionths of an inch for blocks

Automatic sizing (cylindrical) grinder made in several sizes.



One of several sizes of automatic milling machine made in large quantities.



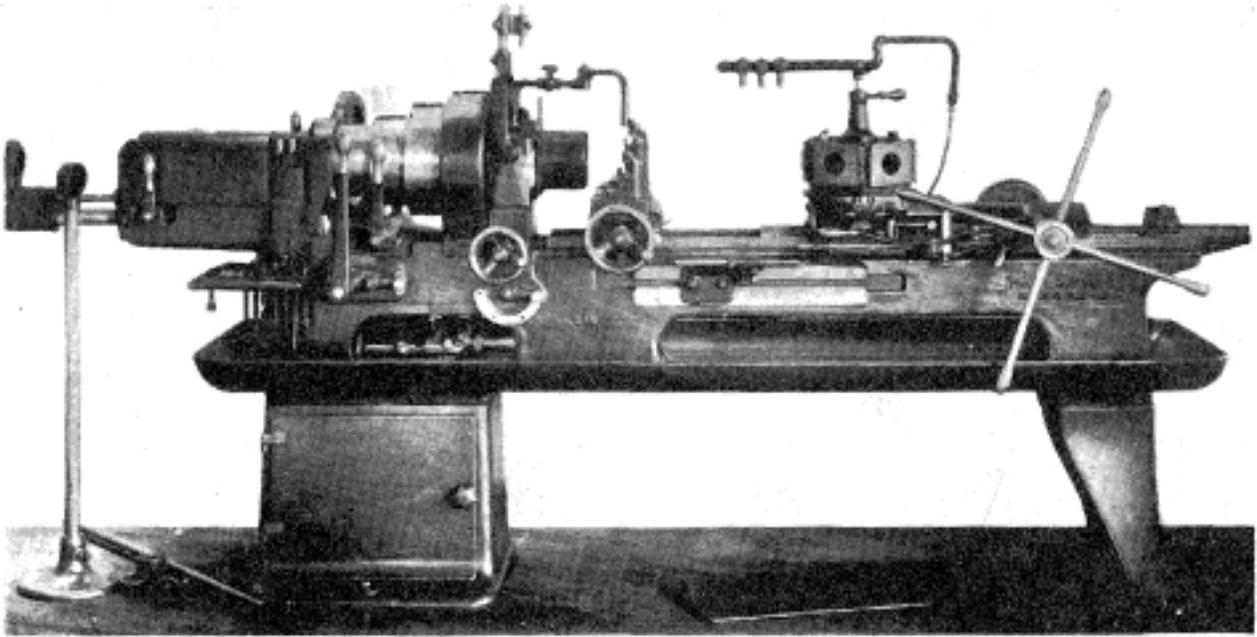
P&W 4 inch Spline Milling Machine.

up to six tenths of an inch, and with similar guarantees in proportion for larger sizes. This was the beginning of Pratt & Whitney Hoke Precision Gage Blocks.

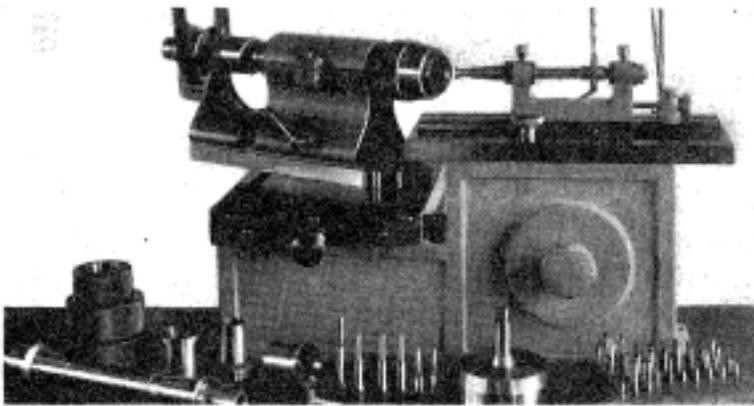
During the dull period from 1920 to 1925, Pratt & Whitney Company revised and re-designed its products — work which the feverish war activities had curtailed. It had been necessary to turn out machine tools in the quickest possible manner, and there was no time for new developments which were not absolutely essential. This re-creation period saw Pratt & Whitney engineers delving deeply into new metals and applying in a practical peace-time way the knowledge learned in war. New designs were worked out, better methods were developed, and Pratt & Whitney products were raised to new and better standards.

During the same period the company housecleaned its shop effectively. As a result of the war the shop had become jammed with equipment for producing almost anything in metal. This growth necessarily had been almost overnight, and scant care had been given to the niceties of smooth production and ease in handling work through the plant.

In 1924, the company analyzed carefully every detail of its manufacturing procedure and rearranged itself in a most efficient manner. Entire jobs were moved and re-equipped so that the kinks in the production line were straightened out, and the flow of work through the plant became smooth and highly efficient. The details of this house cleaning and reordering are unnecessary here, but it is sufficient to say that the plant became modern in every corner, with fresh paint gleaming from walls and ceilings. A systematic, business-like activity was evident



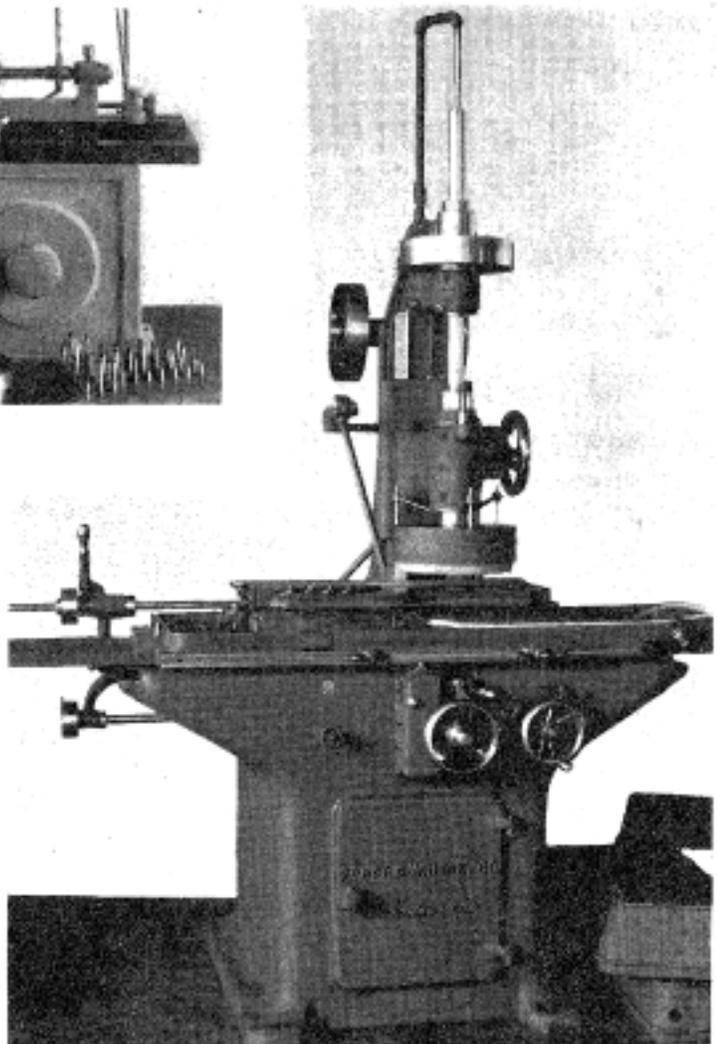
One of several sizes of P&W turret lathes.



Bench bushing grinder.



The ancestor of the present 14 inch Vertical Surface Grinder.



everywhere. Heating systems were revised and modernized. Electrical installations were brought up-to-date and the latest devices of electrical engineers were installed to carry and control power throughout the plant. Everything from cellar to roof was scrutinized and rearranged.

Since that date, the Pratt & Whitney plant has continued to be model one. As new things are developed which are better than the old ones and which show savings in time or money, they are installed.

The result is the splendid modern plant of the Pratt & Whitney Company, extending over many acres of ground close to the center of the city of Hartford, giving employment to more than 2,000 people.

The names "Pratt & Whitney" have been engraved and molded in metal millions of times and stamped into the minds of men who work in metals and to whom "accuracy" is a daily watchword.

Two men in a little room in 1860 — in 1930 thousands of men, branches in many cities, representatives all over the world . . . and the unchanged and unchanging ideal of accuracy that wrought this great work still guides the hands into which this trust has been placed.

